returned to Britain. Ultimately the decision for them remaining will be a socio-political one, as supposed to an ecologically based decision, with the next two to three years being critical for the future of beavers in Britain, so watch this space.

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Impact of the New Zealand flatworm on Scotland's biodiversity

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The detrimental impact of the New Zealand flatworm (*Arthurdendyus triangulatus*) on both Scotland's above and below ground biodiversity, could in certain parts of the country be considerable. Below ground earthworms play a crucial role in the ecology of many soils as they have a beneficial impact on nutrient cycling, drainage and soil structure while above ground they are a major constituent of the diet of many birds and mammals.

In much of Scotland, earthworm populations are likely to be missing or low in Scotland as many of the soils have a low pH (below that tolerated by earthworms) or the soils are intensively cultivated especially in the east of Scotland (Boag *et al.*, 1998). However, in fields where grass is the main crop, then earthworm numbers can be high (Boag *et al.*, 1997). Jones et al., (2001) studied the impact of the New Zealand flatworm on the composition of the earthworm community in two New Zealand flatworm infested sites and compared these with flatworm free sites in western Scotland and found the numbers of both endogeic and anecic earthworm species were significantly reduced. Experimental research in Northern Ireland has confirmed that the numbers of the anecic species *Lumbricus terestris* were significantly reduced as was the total biomass of earthworms (Murchie & Gordon, 2013). The indirect impact of reduced earthworm numbers on the size and composition of the populations of other creatures which inhabit soil e.g. collembola, nematodes, enchitraeids and fungi and bacteria have never been investigated.

Alford *et al.*, (1985) did a comprehensive inventory of the above ground animals which feed of earthworms and concluded that where the New Zealand flatworm became established it may lead to the extinction of moles (*Talpa europaea*), and possible local extinction of common shrew (*Sorex araneus*), badger (*Meles meles*), hedgehog (*Erinaceus europaeus*) stoat (*Mustela erminea*) but that foxes (*Vulpes vulpes*) would probably be unaffected. What little evidence we have so far suggests these predictions may be true since in fields in the west of Scotland where moles were once plentiful but have become infested with the New Zealand flatworms moles have been eradicated (Boag & Yeates, 2001). Alford *et al.* (1995) also predicted that there would be a detrimental impact on a number of bird species. At present no research is being undertaken to ascertain the direct or indirect impact of the New Zealand flatworm on Scotland's above or below ground biodiversity.

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How does an introduced vertebrate host species affect the risk of Lyme disease? Characterising Grey squirrels (*Sciurus carolinensis*) as tick hosts and reservoir hosts of *Borrelia burgdorferi* s.l. in Scotland

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Lyme borreliosis caused by *Borrelia burgdorferi* sensu lato (*B. burgdorferi* s.l.) is a tick-transmitted bacterial zoonosis which is maintained in a complex tick-wildlife cycle. In Scotland, Lyme borreliosis is of increasing concern as numbers of human cases have risen sharply in the last decade. The introduction of a competent reservoir species may modify local disease dynamics and increase the risk of Lyme borreliosis to humans, by increasing the number of infected ticks in an area.

Grey squirrels (*Sciurus carolinensis*) were introduced to the UK approximately 100 years ago and have become widely established. The current population is estimated at over one million with at least 200,000 grey squirrels present in Scotland (Fig. 1). Previous research on a small number of animals has shown that they are competent reservoir hosts for at least two genospecies of Lyme disease, *Borrelia afzelii* and *Borrelia burgdorferi* sensu stricto. So far the role of grey squirrels as tick hosts and *B. burgdorferi* s.l. reservoir hosts in Scotland has not been quantified.

Research objectives are to; 1) Quantify and characterise the tick parasite community of grey squirrels. 2) To quantify the prevalence of *B. burgdorferi* s.l. infection in grey squirrels by testing both tissues and by xenodiagnosis (testing tick larvae which have fed on squirrels). 3) To carry out objectives 1 & 2 at regional and national scales in Scotland. 4) To quantify the genetic diversity of *B. burgdorferi* s.l. from grey squirrels using multilocus sequence typing (MLST).

Preliminary results indicate that infection prevalence in squirrels is much higher than in native rodent species, and that squirrels are infected with a diverse range of species of *Borrelia*, confirming this species potential role as a reservoir host for *B. burgdorferi* s.l. in Scotland. Squirrels are frequently infested with larval and nymphal stages of *Ixodes ricinus*, also known as the deer or sheep tick (Fig. 2) and the main vector of Lyme borreliosis in the UK. Further analysis is underway to understand the spatial, temporal and host drivers of *Borrelia* infection in grey squirrels.

Fig.1. Grey squirrel (*Sciurus carolinensis*). Photo credit: Aileen Adam.

Fig. 2. Ixodes ricinus, adult female. Photo credit: Christina M. Berry/ University of Bristol.